

*1/2 out*  
*1/2 out*  
elastic plate 2. In other words, a first free space is provided after second section 5d for allowing axial movement of the flywheel body. A radially extending inner surface 5f of the flywheel facing the elastic plate 2 is spaced apart from the elastic plate 2 by a predetermined distance for ensuring an elasticity of the elastic plate 2. In other words, a first clearance or second free space is provided between inner surface 5f and the elastic plate 2 for allowing axial movement of the flywheel body. --

### IN THE CLAIMS:

Please cancel claims 1-12, 16, 28, 31 and 43-68 without prejudice or disclaimer. Original patent claims 1-12 are reproduced below with bracketing in accordance with 37 C.F.R. § 1.121(b)(2)(i)(c).

[1. A flywheel for a power transmission system for transmitting engine torque to a driven unit, comprising:

an elastic plate secured to a crankshaft to rotate therewith;

a flywheel body secured to said elastic plate and having an engageable surface for engaging with a clutch disc; and

a reinforcing member for reinforcing said elastic plate at a portion of said elastic plate which is secured to said crankshaft;

said elastic plate having an axial rigidity in the range of 600 kg/mm to 2200 kg/mm so as to ensure transmission of engine torque to said driven unit while decreasing noise produced by a bending vibration of said crankshaft;

wherein each of said elastic plate, said flywheel body and said reinforcing member comprises a first portion, said first portion of said flywheel body being placed axially between said first portions of said elastic plate and said reinforcing member, and said first portions of said elastic plate, said flywheel body and said reinforcing member defining clearances for allowing said first portion of said flywheel body to move axially between said first portions of said elastic plate and said reinforcing member.

2. A flywheel as set forth in claim 1, wherein said axial rigidity is in the range of 600 kg/mm to 1700 kg/mm.

3. A flywheel as set forth in claim 2, wherein an axial run-out of said engageable surface when rotated by said crankshaft is no more than 0.1 mm.

4. A flywheel according to claim 1, wherein said reinforcing member (4) and said elastic plate (2) are fastened to said crankshaft (1) by a fastening means (3), and said elastic plate is clamped between said crankshaft and said reinforcing member.

5. A flywheel according to claim 4, wherein said elastic plate is circular and comprises an outer peripheral portion (2b) surrounding said first portion of said elastic plate, so that said first portion of said elastic plate is an inner portion of said elastic plate, said flywheel body comprises an outer peripheral portion (5a) which surrounds said first portion of said flywheel body, so that said first portion of said flywheel body is an inner portion of said flywheel body, said outer peripheral portions of said elastic plate and said flywheel body are fastened together by a second fastening means (6), said inner portion of said flywheel body comprises an inwardly facing inside cylindrical surface defining a central circular hole (5b), said reinforcing member comprises a cylindrical portion (4a) which is received in said circular hole (5b) of said flywheel body, and comprises an outwardly facing outside cylindrical surface surrounded by said inwardly facing cylindrical surface of said flywheel body, said first portion of said reinforcing member is in the form of an outward flange (4b), said first portion of said flywheel body is slidably mounted on said cylindrical portion of said reinforcing member so that said first portion of said flywheel body is axially slidable between said inner portion of said elastic plate and said outward flange of said reinforcing member.

6. A flywheel according to claim 4, wherein said inner portion of said flywheel body comprises a first surface (5f) which is substantially parallel to said engageable surface (5g) and which faces toward said elastic plate, and a second surface (5d) which is substantially parallel to said engageable surface and which faces toward said outward flange of said reinforcing member, said inner portion of said elastic plate comprising an abutting surface confronting said first surface of said flywheel body and limiting an axial movement of said inner portion of said elastic plate by abutting against said first surface of said flywheel body, said outward flange of said reinforcing member comprises an abutting surface confronting said second surface of said flywheel body and

limiting the axial movement of said inner portion of said flywheel body by abutting against said second surface of said flywheel body, an axial distance between said first and second surfaces of said flywheel body is smaller than an axial distance between said abutting surfaces of said elastic member and said reinforcing member.

7. A flywheel according to claim 6, wherein said second surface (5d) of said inner portion of said flywheel body is located axially between said first surface (5f) and said engageable surface (5g) of said flywheel body.

8. A flywheel for a power transmission system for transmitting engine torque to a driven unit, comprising:

an elastic plate secured to a crankshaft to rotate therewith;

a flywheel body secured to said elastic plate and having an engageable surface for engaging with a clutch disc; and

a reinforcing member for reinforcing said elastic plate at a portion of said elastic plate which is secured to said crankshaft; and

said engageable surface having an axial run-out which is equal to or less than 0.1 mm;

wherein each of said elastic plate, said flywheel body and said reinforcing member comprises a first portion, said first portion of said flywheel body being placed axially between said first portions of said elastic plate and said reinforcing member, and said first portions of said elastic plate, said flywheel body and said reinforcing member defining clearances for allowing said first portion of said flywheel body to move axially between said first portions of said elastic plate and said reinforcing member.

9. A flywheel assembly comprising:

a driving shaft (1) for transmitting torque;

a circular elastic member (2) comprising an outer portion and an inner portion and extending radially inwardly from said outer portion to said inner portion, said inner portion of said elastic member being fastened to a shaft end of said driving shaft;

an annular flywheel member (5) comprising an outer portion and an inner portion and extending radially inwardly from said outer portion to said inner portion of said flywheel member, said outer portion of said flywheel member being fastened to said outer

portion of said elastic member, said inner portion of said flywheel member comprising a central circular hole; and

a reinforcing member (4) comprising a cylindrical portion (4a) axially extending from a first end to a second end, an inner portion extending radially inwardly from said first end of said cylindrical portion, and an outward flange (4b) extending radially outwardly from said second end of said cylindrical portion, said inner portion of said reinforcing member being fastened to said shaft end of said driving shaft, said cylindrical portion of said reinforcing member being fit in said circular hole of said flywheel member with a clearance to form a loose fit;

wherein said inner portion of said elastic member is fixedly clamped between said shaft end of said driving shaft and said inner portion of said reinforcing member, said inner portion of said flywheel member is loosely fit over said cylindrical portion of said reinforcing member and located axially between said inner portion of said elastic member and said outward flange of said reinforcing member, said outward flange is axially spaced from said inner portion of said elastic member at an axial distance which allows axial movement of said inner portion of said flywheel body between said inner portion of said elastic member and said outward flange of said reinforcing member.

10. A flywheel assembly according to claim 3, wherein said elastic member has an axial rigidity which is in the range of 600 kg/mm to 2200 kg/mm.

11. A flywheel assembly according to claim 9, wherein a wall thickness of said inner portion of said reinforcing member is greater than a wall thickness of each of said outward flanges of said reinforcing member and said inner portion of said elastic member, said wall thickness of each of said inner portion and said outward flange of said reinforcing member and said inner portion of said elastic member being a dimension measured in an axial direction parallel to an axis of said driving shaft.

12. A flywheel assembly according to claim 9, further comprising a first fastening means for fastening said outer portions of said elastic member and said flywheel member together, and a second fastening means for fastening said inner portions of said elastic member and said reinforcing member to said shaft end of said driving shaft, each of

said first and second fastening means comprises screw fasteners extending axially along an axis of said driving shaft.]

Please add the following new claims:

-- 69. A method for shifting a resonance frequency of a flexural or bending vibration of a crankshaft assembly of an internal combustion engine out of a target frequency band of a forced vibration, comprising:

(a) providing a clutch having a clutch disk with a clutch facing coupled to a transmission;

(b) providing a flywheel assembly flywheel assembly of a power transmission system for transmitting engine torque, said flywheel assembly comprising:

a crankshaft;

an elastic plate comprising an inner portion secured to a shaft end of said crankshaft;

a flywheel body secured to said elastic plate and having an engaging surface for engaging with the clutch disc; and

a reinforcing member for reinforcing said elastic plate at said inner portion of said elastic plate;

wherein said elastic plate has an axial rigidity in the range of 600 kg/mm to 2200 kg/mm so as to ensure transmission of engine torque through said flywheel assembly, while decreasing noise produced by a bending vibration of said crankshaft;

wherein said elastic plate is clamped axially between said reinforcing member and said shaft end of said crankshaft, and

wherein a first portion of said flywheel moves axially with respect to said reinforcing member and said elastic plate,

wherein said reinforcing member has a radially extending portion which extends at least inwardly of said flywheel body, and wherein said elastic plate comprises a first portion, said first portion of said flywheel body being placed axially after said first portion of said elastic plate, and said first portions of said flywheel body and said elastic plate defining a first clearance and said flywheel body having a first free space on a side opposite of the first clearance for allowing said first portion of said flywheel body to move axially within the first clearance and the free space;

(c) engaging said clutch with said flywheel assembly to transmit the driving power to the transmission through the clutch;

(d) accelerating the clutch and flywheel assembly, wherein the clutch and flywheel assembly vibrates at a frequency of from 200 to 500 Hz during acceleration.

70. A method according to claim 69, wherein the axial displacement of the engaging surface is no more than 1 mm when an axial load of 600 kg to 2200 kg is applied to the engaging surface.

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71. A method according to claim 69, further comprising: (e) disengaging said clutch from said flywheel assembly.

72. A method for shifting a resonance frequency of a flexural or bending vibration of a crankshaft assembly of an internal combustion engine out of a target frequency band of a forced vibration, comprising:

(a) providing a clutch having a clutch disk with a clutch facing coupled to a transmission;

(b) providing a flywheel assembly of a power transmission system for transmitting engine torque, said flywheel assembly comprising:

a crankshaft;

an elastic plate comprising an inner portion secured to a shaft end of said crankshaft;

a flywheel body secured to said elastic plate and having an engaging surface for engaging with the clutch disc; and

a reinforcing member for reinforcing said elastic plate at said inner portion of said elastic plate;

wherein said elastic plate has an axial rigidity in the range of 600 kg/mm to 2200 kg/mm so as to ensure transmission of engine torque through said flywheel assembly, while decreasing noise produced by a bending vibration of said crankshaft;

wherein said elastic plate is clamped axially between said reinforcing member and said shaft end of said crankshaft, and

wherein a first portion of said flywheel moves axially with respect to said reinforcing member and said elastic plate,

wherein said reinforcing member has a radially extending portion which extends at least inwardly of said flywheel body, and wherein said elastic plate comprises a first portion, said first portion of said flywheel body being placed axially after said first portion of said elastic plate, and said flywheel body having a first free space on a side opposite of the flywheel facing the elastic plate for allowing said first portion of said flywheel body to move axially within the free space;

(c) engaging said clutch with said flywheel assembly to transmit the driving power to the transmission to through the clutch;

(d) accelerating the clutch and flywheel assembly, wherein the clutch and flywheel assembly vibrates at a frequency of from 200 to 500 Hz during acceleration.

73. A method according to claim 69, wherein said first portions of said flywheel body and said elastic plate define a second free space consisting essentially of said first clearance.

74. A method according to claim 69, wherein said first portion of said flywheel body slidably contacts an axial surface of said radially extending portion of said reinforcing member.

75. A method according to claim 69, wherein said flywheel body axially moves corresponding to said axial rigidity of said elastic plate in the range of 600 kg/mm to 2200 kg/mm without contact on its radial surfaces when said flywheel is engaged and disengaged.

76. A method according to claim 69, wherein an axial run-out of said engaging surface when rotated by said crankshaft is no more than 0.1 mm.

77. A method according to claim 69, wherein said elastic plate has an axial rigidity in the range of 600 kg/mm to 2200 kg/mm so as to ensure transmission of engine torque through said flywheel assembly, while decreasing noise produced by a bending vibration of said crankshaft; and wherein said flywheel body axially moves corresponding to said axial rigidity of said elastic plate in the range of 600 kg/mm to 2200

kg/mm without contact on its radial surfaces when said flywheel is engaged and disengaged.

78. A method according to claim 69, wherein said axial rigidity is in the range of 600 kg/mm to 1700 kg/mm.

79. A method according to claim 78, wherein an axial run-out of said engaging surface when rotated by said crankshaft is no more than 0.1 mm.

80. A method according to claim 69, wherein said elastic plate is clamped axially between said reinforcing member and said shaft end of said crankshaft by a fastening means.

81. A method according to claim 69, wherein said elastic plate is circular and comprises an outer peripheral portion (2b) surrounding said first portion of said elastic plate, so that said first portion of said elastic plate is an inner portion of said elastic plate, said flywheel body comprises an outer peripheral portion (5a) which surrounds said first portion of said flywheel body, so that said first portion of said flywheel body is an inner portion of said flywheel body, said outer peripheral portions of said elastic plate and said flywheel body are fastened together by a second fastening means (6), said inner portion of said flywheel body comprises an inwardly facing inside cylindrical surface defining a central circular hole (5b), said reinforcing member comprises a cylindrical portion (4a) which is received in said circular hole (5b) of said flywheel body, and comprises an outwardly facing outside cylindrical surface surrounded by said inwardly facing cylindrical surface of said flywheel body.

82. A method according to claim 81, wherein said inner portion of said flywheel body comprises a first surface (5f) which is parallel to said engaging surface (5g) and which faces toward said elastic plate, and a second surface (5d) which is parallel to said engaging surface, said inner portion of said elastic plate comprising an abutting surface confronting said first surface of said flywheel body and limiting an axial movement of said inner portion of said flywheel body by abutting against said first surface of said flywheel body.



83. A method according to claim 82, wherein said second surface (5d) of said inner portion of said flywheel body is located axially between said first surface (5f) and said engaging surface (5g) of said flywheel body.

84. A method according to claim 69, wherein:  
said elastic plate is a circular elastic plate (2) which further comprises an outer portion, and said inner portion extends radially inwardly from said outer portion to said inner portion;

said flywheel body is an annular flywheel body (5) which comprises an outer portion and an inner portion and extending radially inwardly from said outer portion to said inner portion of said flywheel body, said outer portion of said flywheel body being fastened to said outer portion of said elastic plate, said inner portion of said flywheel body comprising a central circular hole; and

said reinforcing member further comprises a cylindrical portion (4a) axially extending from a first member end to a second member end, an inner portion extending radially inwardly from said first member end of said cylindrical portion, and an outward flange (4b) extending radially outwardly from said second member end of said cylindrical portion, said inner portion of said reinforcing member being fastened to said shaft end of said crankshaft, said cylindrical portion of said reinforcing member being fit in said circular hole of said flywheel body with a clearance to form a loose fit;

wherein said inner portion of said elastic plate is fixedly clamped between said shaft end of said crankshaft and said inner portion of said reinforcing member, said inner portion of said flywheel body is fit over said cylindrical portion of said reinforcing member.

85. A method according to claim 84, wherein a wall thickness of said inner portion of said reinforcing member is greater than a wall thickness of each of said outward flange of said reinforcing member and said inner portion of said elastic plate, said wall thickness of each of said inner portion and said outward flange of said reinforcing member and said inner portion of said elastic plate being a dimension measured in an axial direction parallel to an axis of said crankshaft.

86. A method according to claim 84, further comprising a first fastening means for fastening said outer portions of said elastic plate and said flywheel body together, and a second fastening means for fastening said inner portions of said elastic plate and said reinforcing member to said shaft end of said crankshaft, each of said first and second fastening means comprises screw fasteners extending axially along an axis of said crankshaft.

87. A method according to claim 69, wherein said radially extending portion further comprises a radially extending section (4b) at least partially overlapping the first portion of said flywheel body in a radial direction.

88. A method according to claim 72, wherein an axial run-out of said engaging surface when rotated by said crankshaft is no more than 0.1 mm.

89. A method according to claim 72, wherein said elastic plate is clamped axially between said reinforcing member and said shaft end of said crankshaft by a fastening means.

90. A method according to claim 72, wherein said elastic plate is circular and comprises an outer peripheral portion (2b) surrounding said first portion of said elastic plate, so that said first portion of said elastic plate is an inner portion of said elastic plate, said flywheel body comprises an outer peripheral portion (5a) which surrounds said first portion of said flywheel body, so that said first portion of said flywheel body is an inner portion of said flywheel body, said outer peripheral portions of said elastic plate and said flywheel body are fastened together by a second fastening means (6), said inner portion of said flywheel body comprises an inwardly facing inside cylindrical surface defining a central circular hole (5b), said reinforcing member comprises a cylindrical portion (4a) which is received in said circular hole (5b) of said flywheel body, and comprises an outwardly facing outside cylindrical surface surrounded by said inwardly facing cylindrical surface of said flywheel body.

91. A method according to claim 90, wherein said inner portion of said flywheel body comprises a first surface (5f) which is parallel to said engaging surface (5g)

and which faces toward said elastic plate, and a second surface (5d) which is parallel to said engaging surface, said inner portion of said elastic plate comprising an abutting surface confronting said first surface of said flywheel body and limiting an axial movement of said inner portion of said flywheel body by abutting against said first surface of said flywheel body.

92. A method according to claim 91, wherein said second surface (5d) of said inner portion of said flywheel body is located axially between said first surface (5f) and said engaging surface (5g) of said flywheel body.

93. A method according to claim 72, wherein:

said elastic plate is a circular elastic plate (2) which further comprises an outer portion, and said inner portion extends radially inwardly from said outer portion to said inner portion;

said flywheel body is an annular flywheel body (5) which comprises an outer portion and an inner portion and extending radially inwardly from said outer portion to said inner portion of said flywheel body, said outer portion of said flywheel body being fastened to said outer portion of said elastic plate, said inner portion of said flywheel body comprising a central circular hole; and

said reinforcing member further comprises a cylindrical portion (4a) axially extending from a first member end to a second member end, an inner portion extending radially inwardly from said first member end of said cylindrical portion, and an outward flange (4b) extending radially outwardly from said second member end of said cylindrical portion, said inner portion of said reinforcing member being fastened to said shaft end of said crankshaft, said cylindrical portion of said reinforcing member being fit in said circular hole of said flywheel body with a clearance to form a loose fit;

wherein said inner portion of said elastic plate is fixedly clamped between said shaft end of said crankshaft and said inner portion of said reinforcing member, said inner portion of said flywheel body is fit over said cylindrical portion of said reinforcing member.

94. A method according to claim 72, wherein said elastic plate has an axial rigidity which is in the range of 600 kg/mm to 1700 kg/mm.

95. A method according to claim 93, wherein a wall thickness of said inner portion of said reinforcing member is greater than a wall thickness of each of said outward flange of said reinforcing member and said inner portion of said elastic plate, said wall thickness of each of said inner portion and said outward flange of said reinforcing member and said inner portion of said elastic plate being a dimension measured in an axial direction parallel to an axis of said crankshaft.

96. A method according to claim 93, further comprising a first fastening means for fastening said outer portions of said elastic plate and said flywheel body together, and a second fastening means for fastening said inner portions of said elastic plate and said reinforcing member to said shaft end of said crankshaft, each of said first and second fastening means comprises screw fasteners extending axially along an axis of said crankshaft.

97. A method according to claim 72, wherein said radially extending portion further comprises a radially extending section (4b) at least partially overlapping the first portion of said flywheel body in a radial direction.

98. A method according to claim 72, wherein the axial displacement of the engaging surface is no more than 1 mm when an axial load of 600 kg to 2200 kg is applied to the engaging surface.

99. A method according to claim 72, further comprising: (e) disengaging said clutch from said flywheel assembly.

100. A method according to claim 72, wherein said first portion of said flywheel body slidably contacts an axial surface of said radially extending portion of said reinforcing member. --